

ECE 403
Senior Design II

Options Considered Document

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Introduction:

A wind turbine is a device that converts mechanical energy into electricity. They each consist of the following parts: a rotor, rotor blades, hub, nacelle, gearbox, connecting shafts, support bearings, generator, and tower.

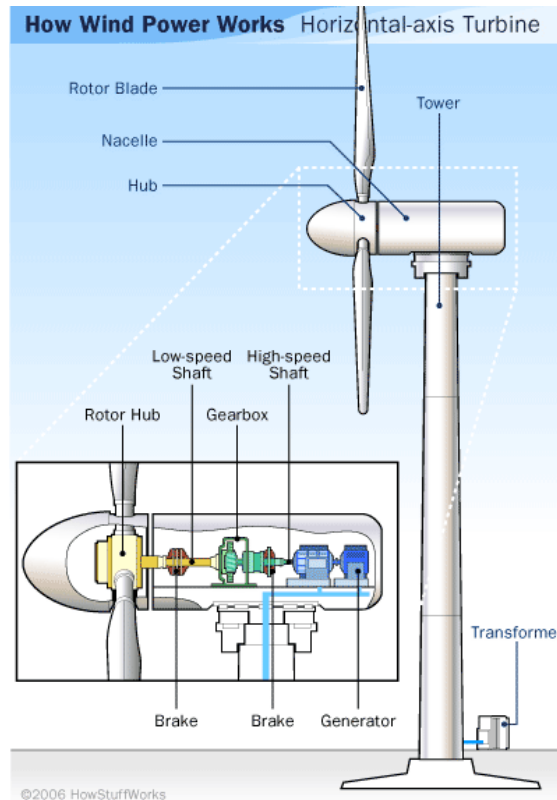


Figure 1: Wind Turbine Nomenclature

The focus of the Novel Wind Turbine is to create a cheaper alternative to the existing large wind turbines. We will need to have low-cost materials with high-volume production. It is also necessary to run at maximum efficiency while ensuring reliability.

To achieve this goal, the project advisor Dr. Bei Gou has designed a method which is expected to concentrate the wind flow into the rotor blades, thus increasing efficiency in generation.

Currently, due to the average cost of wind turbines, they are not accessible to the general public. The Novel Wind Turbine is designed to be cost effective while still maintaining a high level of production.

The Novel Wind Turbine addresses the problem by introducing a significantly cheaper, reliable, and efficient prototype which is designed to operate at lower speeds.

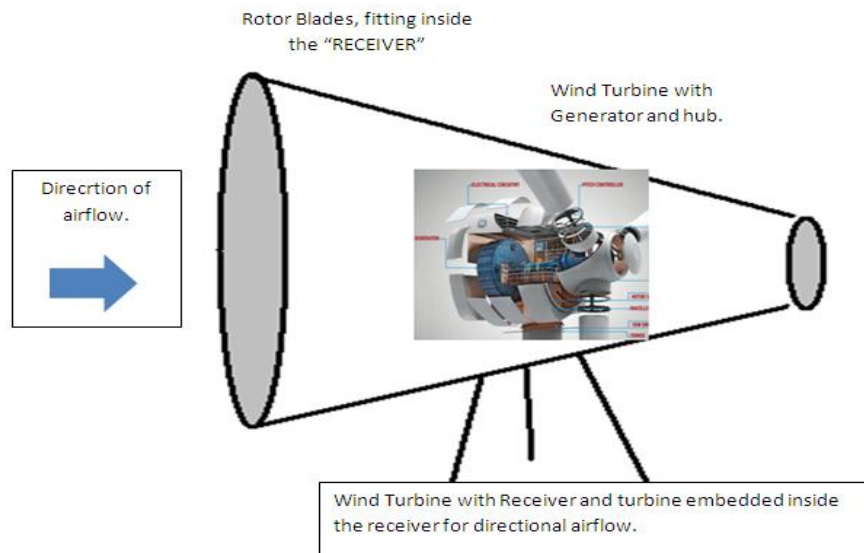


Figure 2: Novel Wind Turbine Sketch

Previous Work:

Compact Wind Acceleration Turbine

There are similar existing products related to our future design. Currently, Optiwind is beginning production of their patented Compact Wind Acceleration Turbines (CWAT). This structure is most similar to our design because the purpose is to accelerate the wind flow.



Figure 3: Compact Wind Acceleration Turbine

WindTamer 8.0 GT

Arista Power has a new product on the market called the WindTamer 8.0 GT. Their purpose is to build a smaller, quieter, and safer wind turbine. Arista's product is intended for slower wind speeds, similar to our future product.



Figure 4: WindTamer8.0 GT

Compressed Air Wind Turbine

Catching Wind Power is a newly developed company that has already patented their compressed air wind turbine. The idea that they use is to squeeze the wind and compress it to create more power at the turbine.

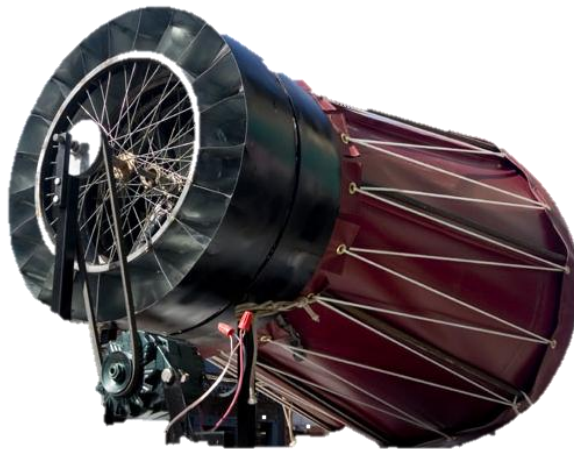


Figure 5: Compressed Air Wind Turbine

Design Options

Included below are several options to consider for optimization of cost and efficiency.

Height/Location

Advantages:

- Place above housing
- With proper height can be effective anywhere

Disadvantages:

- Height adds cost
- Height makes installation more difficult

Screen/Filter

Advantages:

- Protect blades
- Safer for birds
- Filter debris

Disadvantages:

- Restrict airflow
- Added weight
- More cost

Materials

Wood –

Advantages:

- Cost effective
- Easy to shape

Disadvantages:

- Weak
- Not weather resistant

Steel –

Advantages:

- Strong

Disadvantages:

- Expensive compared to other equivalent materials
- Heavy
- Possible rust

Aluminum –

Advantages:

- Light
- Strong
- Weather resistant

Disadvantages:

- Above average cost

Plastic –

Advantages:

- Cost effective
- Weather resistant

Disadvantages:

- Weak if light, strong if heavy

Carbon Fiber –

Advantages:

- Very light
- Very strong
- Weather resistant

Disadvantages:

- Extremely expensive

Shape

Curved –

Advantages:

- Possible to shorten length
- Strong

Disadvantages:

- Difficult to construct

Straight –

Advantages:

- Easier to construct
- Cheaper than curved

Disadvantages:

- Heavier
- More material needed
- Less strength

Budget

<u>Part</u>	<u>Quantity</u>	<u>Cost per unit</u>	<u>Total Cost</u>	<u>Notes</u>
Rotor Blades	1 set	~\$250	~\$250	Construction of turbine
Generator	1	~\$150	~\$150	
Tower	1	~\$50	~\$50	
Hub	1	~\$50	~\$50	
Wood	To be determined	4x8 sheet \$5-10	~\$50	Outer receiver
Plastic	To be determined	4x8 sheet \$22	~\$125	Inner receiver
Miscellaneous	To be determined		~\$75	
		Total Cost	~\$750	Estimated
		Proposed Budget	\$1000	

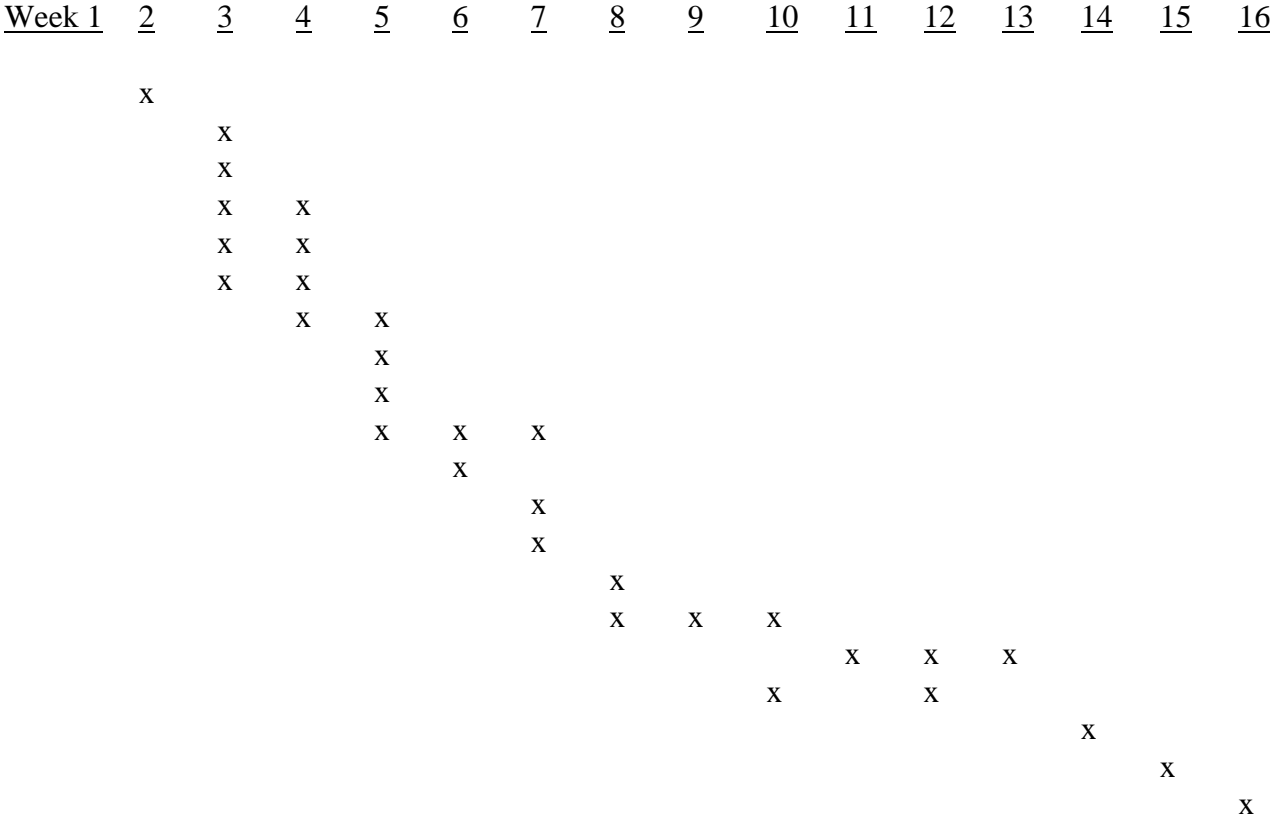
Note: All costs are roughly estimated and aided by research.

Timeline

<u>Event</u>	<u>Week</u>	<u>Who</u>
Initial group meeting	2	All
>>>Meeting with advisor	3	Kevin, Surabhi
Requirements Capture meeting	3	All
Requirements Capture document	3,4	All
>>>Intro, Requirements, Prior Work, Summary	3,4	All
Research	3,4	All
>>>Meeting with advisor	4,5	Jake, Surabhi
Options Considered document	5	All
>>>Intro, Prior Work, Design Options, Budget, Timeline	5	All
Additional research / Calculations	5,6,7	All
>>>Meeting with advisor	6	All
Order Parts	7	All
>>>Meeting with advisor	7	All
Start construction	8	All
>>>Funnel prototype	8,9,10	All
>>>Turbine	11,12,13	All
>>>Meeting with advisor	10,12	All
Demonstrate proof of concept	14	All
Finalize work	15	All
Presentation, end of semester	16	All

Note: This timeline is tentative and is subject to change from week to week.

Gantt Chart



Summary

This project is primarily research based with the intent of producing a modern wind turbine of higher efficiency and less cost, while still maintaining safe operations at appropriate wind speeds.

We want to conduct experiments to determine whether the added efficiency is worth the cost of production. This design is one of many unique but similar products all with different end goals.

To recap, the goal of the Novel Wind Turbine is to create a cheaper alternative to the existing large wind turbines while maintaining safety and efficiency standards.